MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

Trimester-1 2015/2016

EPH7036 – OPTICAL WAVEGUIDES

3 OCTOBER 2015
9.00 A.M – 12.00 P.M
(3 Hours)

INSTRUCTION TO STUDENT

1. This Question paper consists of 3 pages with 4 Questions only.
2. Attempt all the **FOUR** questions. All the questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.

Question1

(a): Explain phase and group velocity.Also deduce the relation among wavelengths .

[9 marks]

(b): Describe numerical aperture with proper diagram

[4 marks]

(c): A symmetric step-index (SI) planar waveguide is made of glass with $n_1 = 1.5$ and $n_2 = 1.49$.The thickness of the guide layer is 9.83 μm and the guide is excited by a source of wavelength $\lambda = 0.85\mu m$.(i) What is the range of the propagation constant?(ii) What is the maximum number of modes supported by the guide ?

[4 marks]

(d): Derive wave equations.

[8 marks]

Question2

(a): A glass fiber has a core diameter of 50 μm ,a core refractive index of 1.62 , and a cladding with a refractive index of 1.604 . If the light having a wavelength of 1300 nm is used . Find

(i) The numerical aperture [3 marks]

(ii) The acceptance angle [3 marks]

(iii) The number of transmission modes [3 marks]

(b): A graded index fiber has a core with a parabolic refractive index profile which has a diameter of $50\mu m$. The fiber has a numerical aperture of 0.2 . Calculate the total number of modes propagating in the fiber when it is operating at a wavelength of $1\mu m$.

[7 marks]

(c): Describe optical kerr effect in brief . [3 marks]

(d): Write short notes on the following

(i) Waveguide dispersion [3 marks]

(ii) Intermodal dispersion [3 marks]

Continued---

Question3

(a): Under beam propagation method Explain wave propagation in optical waveguides

[7 marks]

(b): Describe pulse propagation in optical fibers . [7 marks]

(c): Describe coupled mode equation equations with proper diagram . [6 marks]

(d): Describe the basic theory of star coupler . [5 marks]

Question4

(a): Sketch joint losses based on fiber misalignment with proper theory

[8 marks]

(b): Calculate the insertation loss based on lateral misalignment of two step-index multimode fibers with core radius of $25\mu m$, lateral core offset $3\mu m$ and core refractive index 1.5 . Assume air to be the medium between fibers .

[6 marks]

(c): Give the basic theory of arrayed waveguide grating(AWG) with proper diagram .

[6 marks]

(d): Describe dispersion characteristics of arrayed waveguide grating (AWG)

[5 marks]

End of paper---